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VAN BEEK ET AL.

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Title: LITHOGRAPHIC APPARATUS AND DEVICE MANUFACTURING METHOD

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BRIEF ON APPEAL

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I. INTRODUCTION

This Appeal is from a final Office Action mailed February 27, 2007, rejecting claims 1-20 of the above-identified patent application and an Advisory Action mailed June 19, 2007. This brief is in furtherance of the Notice of Appeal filed on June 27, 2007.

A. Real Party in Interest - 37 C.F.R. §41.37(c)(1)(i)

The real party in interest for this Appeal and the present patent application is ASML Netherlands, B.V., by way of an Assignment recorded on May 6, 2004, in the U.S. Patent and Trademark Office at Reel 015309, Frame 0347.

B. Statement of Related Appeals and Interferences - 37 C.F.R. §41.37(c)(1)(ii)

There are presently no appeals or interferences known to Appellant, Appellant's representatives, or the Assignee, which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

C. Status of Claims - 37 C.F.R. §41.37(c)(1)(iii)

Claims 1-20 are pending in the application. The rejections of claims 1-20 are appealed herein. Claims 1, 14 and 15 are independent. Claims 1-13 depend from claim 1. Claims 16-20 depend from claim 15.

D. Status of Amendments - 37 C.F.R. §41.37(c)(1)(iv)

An Amendment was filed with the U.S. Patent and Trademark Office on November 23, 2005. An Amendment was filed with the U.S. Patent and Trademark Office along with a Request for Continued Examination on June 1, 2006. An Amendment was filed in the U.S. Patent and Trademark Office on November 20, 2006. Finally, an Amendment after Final Rejection was filed with the U.S. Patent and Trademark Office on May 18, 2007. All claim amendments have been entered and are of record.

II. SUMMARY OF CLAIMED SUBJECT MATTER - 37 C.F.R. §41.37(c)(1)(v)

A. Features of the Invention

The invention relates to a lithographic apparatus including an *in situ* cleaning unit configured to clean optical elements and/or parts within the apparatus. Contamination on the surface of elements, such as optical elements like reflectors, lenses, deflectors, sensors or the patterning structure, degrades the performance of the lithographic apparatus. Contamination

may, for example, follow from hydrocarbon contaminants in the apparatus that are deposited on the surfaces. Radiation (especially from EUV radiation) incident on those surfaces breaks the bonds of the hydrocarbons to form chemical bonds between carbon atoms from the hydrocarbons and the surfaces, leaving an amorphous carbon layer. An amorphous carbon layer may absorb a significant fraction of the EUV radiation subsequently incident on those optical surfaces. Therefore, it is desirable to regularly clean optical elements. For the cleaning to be practical, it should be performed *in situ*, be completed quickly, and should not damage the optical surface. In order to clean optical elements and other parts of the apparatus and reduce the risk of damage to such elements and parts to be cleaned, the lithographic apparatus includes a downstream radical source, connected to a gas supply, that provides a beam of radicals, which beam of radicals is directed onto the surface to be cleaned.

B. The Independent Claims on Appeal

The following explanation of the claimed subject matter, with reference to the specification and drawings, is for explanation only. The invention is not limited to the disclosed embodiments.

1. Claim 1

Independent claim 1 recites a lithographic projection apparatus. (*See* FIG. 1). The apparatus comprises a support structure (*see* MT, FIG. 1; paragraph 13, page 5, line 20 and paragraph 38, page 9, line 10) constructed to support a patterning device (*see* MA, FIG. 1; paragraph 13, page 5, line 20 and paragraph 38, page 9, line 11), said patterning device being configured to pattern a beam of radiation according to a desired pattern (*see* FIG. 1; paragraph 13, page 5, line 21, paragraph 14, page 5, line 28 and paragraph 38, page 9, lns. 10-19); a substrate holder (*see* WT, FIG. 1; paragraph 13, page 5, line 21 and paragraph 38, page 9, lns. 12-13) constructed to hold a substrate (*see* W, FIG. 1; paragraph 13, page 5, line 22 and paragraph 38, page 9, line 13); a projection system (*see* PL, FIG. 1; paragraph 13, page 5, line 22, paragraph 38, page 9, line 15 and paragraph 42, page 6, lns. 6-17) constructed and arranged to project the patterned beam onto a target portion (*see* C, FIG. 1; paragraph 13, page 5, line 22 and paragraph 38, page 9, line 16) of the substrate; and a downstream radical source (*see* 10, FIG. 2; paragraph 13, page 5, line 23 and paragraph 44, page 10, lns. 30-33) having a tube (*see* 5, FIG. 2; paragraph 13, page 5, lines 24-25 and paragraph 44, page 11, lines 1-13) connected to a gas supply (*see* paragraph 13, page 5, lns. 23-24) configured to provide a beam of radicals (*see* 7, FIG. 2; paragraph 13, page 5, line 24 and paragraph 44, page 11, lns. 1-13) directed onto a surface (*see* 8, FIG. 2; paragraph 13, page 5, line 25 and

44, page 11, lns. 1-13) of a component to be cleaned (*see* MT, FIG. 1; paragraph 13, page 5, line 25 and paragraph 44, page 11, lns. 11-13). The radicals (*see* 7, FIG. 2; paragraph 13, page 5, line 24 and paragraph 44, page 11, lns. 1-13) are generated within a flow of gas from the gas supply in the tube (*see* paragraph 13, page 5, lns. 23-25 and paragraph 24, page 8, lns. 1-5). The tube of the radical source is constructed and arranged to be moved relative to the surface to be cleaned and/or the component is constructed and arranged to be moved relative to the tube of the radical source so that the beam of radicals is incident on the surface to be cleaned. (*See* 7, FIG. 2; paragraph 20, page 7, lns. 1-8 and paragraph 47, page 11, lns. 25-33).

2. Claim 14

Independent claim 14 recites a device manufacturing method. (*See* paragraph 23, page 7, lns. 26-27). The method comprises providing a beam of radiation (*see* PB, FIG. 1; paragraph 23, page 7, lns. 26-33 and paragraph 38, page 9, lns. 7-19); patterning the beam of radiation (*see* FIG. 1, paragraph 23, page 7, lns. 26-33 and paragraph 38, page 9, lns. 7-19); projecting the patterned beam of radiation (*see* PB, FIG. 1; paragraph 23, page 7, lns. 26-33 and paragraph 38, page 9, lns. 7-19) onto a target portion (*see* C, FIG. 1; paragraph 23, page 7, lns. 26-33 and paragraph 38, page 9, lns. 7-19) of a layer of radiation-sensitive material (*see* paragraph 23, page 7, lns. 26-33); providing a flow of gas from a gas supply (*see* FIG. 2; paragraph 23, page 7, lns. 26-33 and paragraph 44, page 11, lns. 1-13); generating a beam of radicals (*see* 7, FIG. 2; paragraph 23, page 7, lns. 26-33 and paragraph 44, page 11, lns. 1-13) in the flow of gas from the gas supply in a tube of a downstream radical source (*see* 10, FIG. 2; paragraph 13, page 5, lns. 23-25 and paragraph 38, page 5, lns. 7-19); moving the tube (*see* 5, FIG. 2; paragraph 23, page 7, lns. 26-33 and paragraph 44, page 11, lns. 1-13) of the radical source relative to a component comprising a surface (*see* 8, FIG. 2; paragraph 23, page 7, lns. 26-33 and paragraph 44, page 11, lns. 1-13) to be cleaned and/or moving the component relative to the tube of the radical source (*see* 7, FIG. 2; paragraph 20, page 7, lns. 1-8 and paragraph 47, page 11, lns. 25-33); and directing said beam of radicals onto the surface to be cleaned so that the beam of radicals is incident on the surface to be cleaned (*see* FIG. 2; paragraph 23, page 7, lns. 26-33 and paragraph 44, page 11, lns. 1-13).

3. Claim 15

Independent claim 15 recites a lithographic projection apparatus. (*See* FIG. 1). The apparatus comprises a radiation source (*see* LA, FIG. 1; paragraph 38, page 9, line 10

and paragraph 39, page 9, lns. 20-23) that provides a beam of radiation (*see* PB, FIG. 1; paragraph 38, page 9, line 10 and paragraph 39, page 9, lns. 20-23); a support structure (*see* MT, FIG. 1; paragraph 13, page 5, line 20 and paragraph 38, page 9, line 10) constructed to support a patterning device (*see* MA, FIG. 1; paragraph 13, page 5, line 20 and paragraph 38, page 9, line 11), said patterning device being configured to pattern the beam of radiation according to a desired pattern (*see* FIG. 1; paragraph 13, page 5, line 21, paragraph 14, page 5, line 28 and paragraph 38, page 9, lns. 10-19); a substrate holder (*see* WT, FIG. 1; paragraph 13, page 5, line 21 and paragraph 38, page 9, lns. 12-13) constructed to hold a substrate (*see* W, FIG. 1; paragraph 13, page 5, line 22 and paragraph 38, page 9, line 13); a projection system (*see* PL, FIG. 1; paragraph 13, page 5, line 22, paragraph 38, page 9, line 15 and paragraph 42, page 6, lns. 6-17) constructed and arranged to project the patterned beam (*see* PL, FIG. 1; paragraph 13, page 5, line 22 and paragraph 38, page 9, line 16) onto a target portion (*see* C, FIG. 1; paragraph 13, page 5, line 22 and paragraph 38, page 9, line 16) of the substrate. The apparatus also includes a radical source (*see* 10, FIG. 2; paragraph 13, page 5, line 23 and paragraph 44, page 10, lns. 30-33) connected to a gas supply (*see* paragraph 13, page 5, lns. 23-24) and configured to generate a localized beam of radicals (*see* 7, FIG. 2; paragraph 13, page 5, line 24 and paragraph 44, page 11, lns. 1-13) in a flow of gas from the gas supply in a tube (*see* 5, FIG. 2; paragraph 13, page 5, lns. 23-25 and paragraph 24, page 8, lns. 1-5) of the radical source; and a structure (*see* FIG. 2) to direct said beam of radicals onto a surface (*see* 8, FIG. 2; paragraph 13, page 5, line 25 and 44, page 11, lns. 1-13) to be cleaned, wherein said radical source is disposed away from said radiation source such that operating conditions of said radical source do not adversely affect said beam of radiation (*see* paragraph 15, page 6, lns. 1-9), and wherein the tube of the radical source is constructed and arranged to be moved relative to a component comprising the surface to be cleaned and/or the component is constructed and arranged to be moved relative to the tube of the radical source so that the localized beam of radicals is incident on the surface to be cleaned. (*See* 7, FIG. 2; paragraph 20, page 7, lns. 1-8 and paragraph 47, page 11, lns. 25-33).

III. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL – 37 C.F.R. § 41.37(c)(1)(vi)

In the February 27, 2007 final Office Action (hereinafter "the final Office Action"), claims 1-6, 8-16, and 20 were rejected under 35 U.S.C. §103(a) as being unpatentable over

Somekh (U.S. Patent No. 6,427,703) in view of Tanaka *et al.* (U.S. Patent Application Publication No. 2001/0036741) (hereinafter "Tanaka"). Claim 7 was rejected as being unpatentable over Somekh in view of Tanaka, and further in view of Horiike *et al.* (U.S. Patent No. 5,308,791) (hereinafter "Horiike"). Claim 17 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Somekh in view of Tanaka and further in view of Sakai *et al.* (U.S. Patent No. 5,312,519) (hereinafter "Sakai"). Claims 18 and 19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Somekh in view of Tanaka, and further in view of Vane (U.S. Patent No. 6,105,589).

Thus, the grounds of rejection to be reviewed on appeal are:

1) whether claims 1-6, 8-16, and 20 are obvious under 35 U.S.C. §103(a) based on Somekh in view of Tanaka;

2) whether claim 7 is obvious under 35 U.S.C. §103(a) based on Somekh in view of Tanaka, and further in view of Horiike;

3) whether claim 17 is obvious under 35 U.S.C. § 103(a) based in Somekh in view of Tanaka and further in view of Sakai; and

4) whether claims 18 and 19 are obvious under 35 U.S.C. §103(a) based on Somekh in view of Tanaka, and further in view of Vane.

IV. ARGUMENT - 37 C.F.R. §41.37(c)(1)(vii)

A. The Law Regarding Factual Inquiries to Determine Obviousness/Nonobviousness Under 35 U.S.C. § 103(a)

Several basic factual inquiries must be made to determine obviousness or non-obviousness of patent application claims under 35 U.S.C. § 103. These factual inquiries are set forth in Graham v. John Deere Co., 383 US 1, 17, 148 USPQ 459, 467 (1966):

> Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or non-obviousness of the subject matter is determined.

Application of this test, however, involves a factual inquiry. As stated by the Federal Court in In re Ochiai, 71 F.3d 1565, 37 USPQ2d 1127, 1131 (Fed. Cir. 1995):

> [T]he test of obviousness vel non is statutory. It requires that one compare the claim's subject matter as a whole with the prior art to which the subject matter pertains. 35 U.S.C. § 103.
>
> The inquiry is thus highly fact-specific by design.... When the references cited by the Examiner fail to establish a prima facie case of obviousness,

the rejection is improper and will be overturned. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988) (emphasis added).

In rejecting claims under 35 U.S.C. § 103(a), an Examiner bears an initial burden of presenting a *prima facie* case of obviousness. A *prima facie* case of obviousness is established only if there is a suggestion or motivation to combine reference teachings; a reasonable expectation of success; and the prior art references, when combined, teach or suggest all the claim limitations. If an Examiner fails to establish a *prima facie* case, a rejection is improper and will be overturned. *See* In re Rijckaert, 9 F.3d 1531, 28 USPQ2d 1955 (Fed. Cir. 1993). "If examination ... does not produce a prima facie case of unpatentability, then without more, the Applicant is entitled to the grant of the patent." In re Oetiker, 977 F.2d 1443, 1445-46, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992).

Furthermore, as stated in the recent United States Supreme Court decision in *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. ___, 82 USPQ2d 1385 (2007), "Often, it will be necessary for a court to look to interrelated teachings of multiple patents...in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be explicit." *Id.* at slip opinion 14, 82 USPQ2d at 1396, citing *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness").

B. Rejections Under 35 U.S.C. § 103(a)

1. The Cited References

a) Somekh

Somekh discloses a lithography system (200) that includes an oxidizer source (216) that introduces an oxidizer into an illumination chamber (204) and a process chamber (220). *See* Somekh at col. 6, lns. 19-22. Somekh discloses that the oxidizer is provided by the oxidizer source (216) in an activated state. *See* Somekh at col. 6, lns. 37-38. The oxidizer is introduced to the illumination chamber (204) through a nozzle (224) that is inserted through a wall of the illumination chamber (204), and the oxidizer is also introduced to the process chamber (220) through a nozzle (215) that is inserted through a wall of the process chamber (220). *See* Somekh at col. 7, lns. 11-16; FIG. 2A. The nozzles (215, 224) may be aimed or configured to direct the oxidizer over surfaces in the process and illumination chambers (220, 204), respectively. *See* Somekh at col. 7, lns. 19-23.

b) Tanaka

Tanaka teaches a local etching apparatus that is configured to produce radicals for locally etching a relatively thick portion present on the surface of the object to be etched, such as a silicon wafer. *See* Tanaka at [0015] and [0047]. The etching apparatus includes a plasma generator 2 for causing a plasma discharge of gas inside the alumina discharge tube 2 to produce radicals G by means of a microwave generator 10 and a waveguide 11. *See*, e.g., Tanaka at paragraph [0040].

c) Horiike

Horiike discloses an apparatus for processing the surface of a Si wafer. *See* Horiike at Abstract. The apparatus includes a cleaning chamber (3) for cleaning the wafer (1). *See* Horiike at col. 4, lns. 15-28. The wafer (1) is cleaned in the cleaning chamber (3) prior to being moved into the process chamber (8) for processing. *See* Horiike at col. 5, lns. 27-48. A plasma generating section (4) has a plasma generating area (12) that is communicated to an inlet (11) of the cleaning chamber (3). *See* Horiike at col. 4, lns. 51-54.

d) Sakai

Sakai discloses a discharge tube (18) that selectively supplies active species of F*(radical) and O*(radical) to a chamber (3) through an active species introduction port (19). *See* Sakai at col. 3, lns. 49-58. The active species are generally supplied to the chamber (3) and are not formed into a localized beam. *See* Sakai at col. 3, ln. 62 – col. 4, ln. 39. Sakai discloses that the introduction port (19) should be positioned near the portion of the apparatus that has the most serious problem of contamination, *see* Sakai at col. 7, lns. 61-65.

e) Vane

Vane discloses a method and apparatus for cleaning electron microscopes. *See* Vane at Abstract. Vane discloses that a plasma chamber (50) is provided to project a plasma into the full specimen chamber (4). *See* Vane at col. 7, ln. 54 – col. 8, ln. 3; FIG. 1. The plasma chamber (50) is separate from the gas supply (42) and gas from the gas supply (42) is fed into the chamber (4) and into the plasma. *See* Vane at col. 8, lns. 17-26; FIG. 1. Oxygen radicals from the plasma are carried into the chamber by convection. *See* Vane at col. 8, lns. 24-25.

2. Claims 1-6, 8-16 and 20 are Not Obvious Based on Somekh in View of Tanaka

a) Claim 1

The combination of Somekh and Tanaka fails to present a *prima facie* case of obviousness because: 1) there is no motivation or suggestion, either in the references themselves, or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings, and 2) the combination does not include all the limitations of the claims. The Examiner has impermissibly used Appellant's claims as a blueprint to cobble together references and reject the claims under 35 U.S.C. §103. In doing so, the Examiner has not provided any evidence as to why one of ordinary skill in the art would combine the references in the manner that the Examiner has proposed.

As acknowledged by the Examiner on page 3, lines 12-17, of the final Office Action, Somekh does not disclose, teach or suggest a lithographic apparatus comprising, *inter alia*, "a downstream radical ... wherein the radicals are generated within a flow of gas from the gas supply in the tube, and wherein the tube of the radical source is constructed and arranged to be moved relative to the surface to be cleaned and/or the component is constructed and arranged to be moved relative to the tube of the radical source so that the beam of radicals is incident on the surface to be cleaned."

The Examiner attempts to cure the deficiency of Somekh with respect to this claim limitation by relying on Tanaka. Appellant respectfully submits that one of ordinary skill in the art would not combine Somekh and Tanaka and/or modify Somekh in view of Tanaka. For example, Appellant respectfully submits that one of ordinary skill in the art would not combine the etching apparatus of Tanaka with the electron beam lithography apparatus of Somekh at least because Somekh and Tanaka are non-analogous art, teach away from their combination and because the proposed modification of Somekh in view of Tanaka would render Somekh's lithographic apparatus unsatisfactory for its intended purpose.

First, Appellant respectfully submits that Somekh and Tanaka are directed to different fields of endeavor and are non-analogous art, as evidenced by their separate classification. Appellant respectfully submits that one of ordinary skill in the art would not be motivated to modify Somekh in view of Tanaka because Tanaka is non-analogous prior art as it is not from Appellant's field of endeavor nor is it reasonably pertinent to the particular problem with which Appellant was faced. *See* MPEP 2141.01(a).

In support of this, Tanaka discloses an etching method and apparatus configured to etch a relatively thick portion of a surface of a wafer. *See* Tanaka at [0015]. The etching method of Tanaka is, therefore, a **destructive** process that is configured to permanently change the form of an object. This is in striking contrast with the cleaning method of Somekh or that of claim 1 which are **non-destructive** processes, in which the form of the object or component is not modified after the cleaning is completed. *See* Somekh at col. 6, lns. 33-36 ("The selection of the oxidizer **must** be made keeping in mind that the oxidizer should **not corrode or damage** other components of the lithography system," emphasis added).

In further support of this, Tanaka does not remotely disclose, teach or suggest that the etching apparatus could be used as a means to clean any type of object, nor does Tanaka disclose, teach or suggest anything related to photolithography. Tanaka, therefore, is not from an Appellant's field of endeavor, a photolithographic projection apparatus and a device manufacturing method, nor is Tanaka reasonably pertinent to the particular problem faced by Appellant, the use of a downstream radical source to clean a surface of a component for use in a lithographic projection apparatus and a device manufacturing method.

There is absolutely nothing in the disclosure of either Somekh or Tanaka that would suggest to one of ordinary skill in the art the desirability of combining the references. Somekh does not disclose anything regarding etching relatively thick portions of an object. Quite to the contrary, Somekh **teaches away** from it. *See* Somekh at col. 6, lns. 33-36 ("The selection of the oxidizer **must** be made keeping in mind that the oxidizer should **not corrode or damage** other components of the lithography system", emphasis added). Tanaka does not disclose, suggest, or even remotely hint at anything regarding photolithography, not does it disclose anything regarding cleaning a component. The references are completely and totally unrelated in content.

As Tanaka is non-analogous prior art and may not be used as a basis for rejecting the claimed invention, the combination of Somekh and Tanaka does not present a *prima facie* case of obviousness.

Second, Appellant respectfully submits that one of ordinary skill in the art would not be motivated to combine Somekh and Tanaka because these references teach away from their combination. In support of this, Tanaka teaches a local **etching** apparatus that is configured to produce radicals for **etching** a relatively thick portion present on the surface of the object to be etched, such as a silicon wafer. *See* Tanaka at [0015] and [0047]. As such, the etching

apparatus of Tanaka **does not clean** the wafer, but instead **etches** the wafer, which would actually **generate** contaminants rather than clean them away. *See* Tanaka at [0066] ("the relatively thick portion is shaved flat"). This is in striking contrast with Somekh, which discloses that contaminants may cause the critical dimension printed on the wafer to change and pose problems in charged particle beam metrology systems, and that "[t]he selection of the oxidizer **must** be made keeping in mind that the oxidizer should **not corrode or damage** other components of the lithography system". (*See* Somekh at col. 6, lns. 33-36, emphasis added). *See* also Somekh at col. 2, lns. 15-28 and 50-64. Thus, the main objectives of Somekh are to limit as much as possible the formation of contaminants in the apparatus and the corrosion or damage to objects in the apparatus. In view of such teachings and given that Tanaka's etching process inherently generates contaminants and corrodes objects, one of ordinary skill in the art would not be motivated to modify Somekh in view of Tanaka. It is clear that Tanaka, when viewed in its entirety, **teaches away** from Somekh. Thus, for at least this reason, the combination of Somekh and Tanaka fails to present a *prima facie* case of obviousness.

Third, assuming, *arguendo*, that it would have been obvious to combine Somekh and Tanaka, it is respectfully submitted that such combination would render Somekh's lithographic apparatus unsatisfactory for its intended purpose. As noted above, the etching apparatus of Tanaka is configured to etch objects, which would actually generate contaminants rather than clean them away. The Examiner must realize that modifying the cleaning system of Somekh in view of Tanaka would (1) **increase**, **not reduce**, contaminants within the lithographic apparatus and (2) would likely corrode objects located in the process chamber, two effects Somekh intends to prevent. The proposed combination would therefore substantially increase particle deposits on the mask, wafer and or other optical components of Somekh's lithographic apparatus and would cause unwanted deflection of an electron beam that passes through the mask and/or other components. Thus, combining Somekh and Tanaka in the manner the Examiner has proposed would render Somekh's lithographic apparatus inoperable and unsatisfactory for its intended purpose.

In response to Appellant's arguments regarding the lack of motivation or suggestion to combine the teachings of Somekh and Tanaka, the Examiner asserts at page 2 of the Advisory Action that "the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather

the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art." The Examiner goes on to state that the "the Examiner relies on Somekh for the teaching of the cleaning apparatus and relies on the structure of Tanaka et al. for the configuration of Somekh." These arguments lack merit.

First, according to the MPEP 2141.02, "Ascertaining the differences between the prior art and the claims at issue requires interpreting the claim language, and considering both the invention and the prior art references as a whole," and, "[in] determining the differences between the prior art and the claims, the question under 35 U.S.C. §103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious." (Emphasis added). Furthermore, "a prior art reference ***must be considered in its entirety***, *i.e.*, as a whole, ***including portions that would lead away from the claimed invention***." (*See* MPEP §2141.02 citing W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984)). (Emphasis added). That is, the references themselves ***must be considered as a whole***, and ***using portions of a reference is improper***. The Examiner appears to have ignored the fact that Tanaka's apparatus is an etching apparatus that would **increase**, **not reduce**, the formation of contaminants. The Examiner cannot simply pick and choose selective portions of Tanaka's teachings, while flatly ignoring Tanaka's portions that teach away from Somekh, in order to establish a *prima facie* case of obviousness.

Second, if it is the Examiner's position that "the structure of Tanaka et al. [is relied upon] for the configuration of Somekh", then the Examiner cannot ignore the fact that "the structure of Tanaka et al." is an etching apparatus and, as such, any configuration or modification of Somekh's system in view of Tanaka would simply result in an etching apparatus located in a lithographic apparatus. However, this is not the invention of claim 1.

Equally important is the fact that the combination of Somekh in view of Tanaka in the manner the Examiner has proposed fails to disclose, teach or suggest each and every feature recited in claim 1. In particular, the Examiner asserts at page 2 of the Advisory Action that "Somekh discloses a downstream radical source (216) with a gas supply (oxygen), but does not disclose a tube connected to a gas supply." The Examiner goes on to state that "Tanaka et al. teach a gas supply (3) connected to a tube (2) to generate radicals of the plasma generator (1)" and concludes that "modifying Somekh by having a remote gas supply connected to the radical source (216) by a tube discloses the limitations set forth in claim 1." Appellant strenuously disagrees.

According to claim 1, the radicals are generated within a flow of gas from the gas supply in the tube. Thus, merely connecting a movable tube via piping of nozzles (224) of Somekh, as the Examiner has proposed on page 4 of the Office Action or page 2 of the Advisory Action, does not change the fact that the oxidizer source (216) of Somekh provides the nozzles (224) with the oxidizer in the activated state. However, this is not what claim 1 recites. As noted above, the radicals are generated within a flow of gas from the gas supply in the tube. Thus, even if one were to combine Somekh and Tanaka in the manner the Examiner has proposed, such combination would not result in the lithographic apparatus of claim 1.

Further, the Examiner has provided no reasoning as to why one of ordinary skill in the art would modify Somekh to eliminate the oxidizer source (216) and significantly change where the oxidizer is generated. **There simply is none**.

In addition, Appellant respectfully submits that the Examiner has not provided the required motivation or suggestion to combine the teachings of Somekh and Tanaka.

As stated in the recent United States Supreme Court decision in *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. ___, 82 USPQ2d 1385 (2007), "Often, it will be necessary for a court to look to interrelated teachings of multiple patents...in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be explicit." *Id.* at slip opinion 14, 82 USPQ2d at 1396, citing *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness"). Here, the Examiner has only provided conclusory statements, which are insufficient to support a *prima facie* case of obviousness.

In fact, the Examiner has not cited any objective evidence of a motivation or suggestion to combine and modify Somekh and Tanaka. The Examiner has merely stated that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the downstream radical source of Somekh by including a moveable tube connected to the gas supply via piping of nozzles (224) that is moveable over a surface (208; mask) for at least the purpose of maintaining a contaminant-free surface." *See* Office Action dated December 7, 2006 at page 3, lines 1-4. This is not objective evidence of a motivation or suggestion to combine the references.

As an initial matter, Somekh does not disclose that its arrangement of nozzles is in any way inadequate to clean carbon contamination from the surfaces of targeted portions of the electron beam lithography apparatus. As such, it is not clear as to why one of ordinary skill in the art would modify Somekh in view of Tanaka "for at least the purpose of maintaining a contaminant-free surface." Somekh achieves an adequate cleaning without the use of Tanaka's system.

Further, it is respectfully submitted that one of ordinary skill in the art would not modify Somekh in the manner the Examiner has proposed. In support of this, Somekh discloses a cleaning system that introduces an oxidizer in the process chamber until particular partial pressures within the process chamber are reached. *See* Somekh at col. 6, lns. 18-49. In other words, Somekh teaches creating an atmosphere of oxidizer to clean the entire process chamber. With such a cleaning process, Somekh is able to continuously clean all the components located in the chamber. As such, there is clearly no need in Somekh to connect a moveable tube to the gas supplies 215 and 224 to direct the flow of radicals to a particular location.

If anything at all, the proposed modification of Somekh in view of Tanaka is, according to Somekh, undesirable as it would in fact decrease the throughput of the lithographic apparatus of Somekh. In support of this, Somekh discloses that all the elements within the chamber should be cleaned and that such cleaning should not drastically affect the throughput of the lithographic system. *See* Somekh at col. 2, lns. 64-67 and col. 3, lns.1-6. Modifying the cleaning process of Somekh by using a system that locally cleans a surface of a component would, according to Somekh, not only be very expensive and time consuming, but would also limit the throughput of the lithographic system. *Id.* Accordingly, one of ordinary skill in the art would not be motivated to modify the cleaning system of Somekh based on Tanaka in the manner the Examiner has proposed.

The lack of any cogent reason or objective evidence to combine Somekh with Tanaka is a fundamental shortcoming of the Examiner's rejections, and shows that the Examiner is simply engaging in a piecemeal and hindsight reconstruction of the prior art. This is impermissible. *See In re Wesslau*, 353 F.2d 238, 241, 147 USPQ 391, 393 (CCPA 1965) ("Such piecemeal reconstruction of the prior art patents in light of appellant's disclosure is contrary to the requirements of 35 U.S.C. § 103").

Therefore, for at least this reason, the combination of Somekh and Tanaka cannot result in the invention of claim 1. Therefore, the rejection of claim 1 must be withdrawn.

b) Claims 2-6 and 8-13

Claims 2-6 and 8-13 are patentable over Somekh, Tanaka and any combination thereof at least by virtue of their dependency from claim 1 and for the additional features recited therein.

For example, with respect to claim 2, the Examiner relies on col. 6, lns. 25-29 of Somekh as allegedly disclosing, teaching or suggesting a beam of radicals that contains substantially no ionized particles. Appellant respectfully disagrees. The cited portions of Somekh merely disclose that "the oxidizer may be **sourced** from any oxygen containing compound, such as O3, N2O, water vapor, doped oxygen compounds, alcohol compounds and other like compounds that are either neutral or ionized." (Emphasis added). Thus, the cited portions of Somekh merely disclose that the oxidizer may be produced from neutral or ionized particles. The cited portions of Somekh do not disclose, teach or suggest anything related to the content of the beam of radicals. There is simply no disclosure in the cited portions of Somekh of a beam of radicals that contains substantially no ionized particles.

As another example, the Examiner relies on col. 6, lns. 39-43 of Somekh as allegedly disclosing, teaching or suggesting the features of claims 8 and 9. Appellant respectfully disagrees. According to claim 8, the downstream radical source comprises one or more of an RF coil, a pair of DC discharge electrodes, a microwave cavity, and an RF cavity that generates a region of plasma within the flow of gas from the gas supply, the radicals being created in said plasma region. Further, according to claim 9, the downstream radical source comprises a high temperature element located within the flow of the gas from the gas supply, the temperature of the high temperature element being sufficient to cause thermal dissociation to create the radicals. The cited portions of Somekh fail to disclose, teach or suggest these features.

The cited portions of Somekh merely disclose that "the oxidizer is activated by one of several different possible methods, including thermal activation, ozone activation, activation by a microwave source or remote plasma source, or other similar methods." There is no teaching or suggestion in the cited portions of Somekh that a region of plasma is provided in the tube where the radicals are created, nor is there any teaching or suggestion in the cited portions of Somekh of a high temperature element. In particular, while the plasma may be produced by a high temperature element (although not disclosed in Somekh) the plasma is not, in and of itself, an element as recited in claim 9. The plasma does not have any structure

and, as such, cannot be the element of claim 9. The Examiner must realize that if the source of Somekh is turned off, there would be no plasma and, thus, no element.

In addition, the Examiner's position with respect to claims 8 and 9 is in contradiction with his position with respect to claim 11. Specifically, if it is the Examiner's position that Somekh discloses that the region of plasma in which the radicals are formed is located in the tube that extends between the oxygen source 216 and the nozzle 215, then the radicals cannot be created in the oxygen source 216, as alleged by the Examiner at page 5, lns. 19 of the Office Action.

With respect to claim 12, Appellant respectfully submits that Somekh fails to disclose, teach or suggest an apparatus that comprises at least two downstream radical sources and corresponding beams of radicals for cleaning said surface. Thus, according to claim 12, two downstream radical sources are used to clean the same surface of the component. Somekh is silent as to these features. Somekh merely discloses using two sources, one for the illumination chamber, the other one for the process chamber. There is simply no teaching or suggestion as to the use of two downstream radical sources to clean the same surface of the component, as recited in claim 12. The Examiner has manifestly failed to consider these features.

c) Claim 14

Claim 14 is patentable over Somekh, Tanaka and any combination thereof for at least the same reasons as provided above for claim 1 and for the features recited therein. In particular, the combination of Somekh and Tanaka fails to present a *prima facie* case of obviousness because: 1) there is no motivation or suggestion, either in the references themselves, or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings, and 2) the combination does not include all the limitations of the claims. The Examiner has impermissibly used Appellant's claims as a blueprint to cobble together references and reject the claims under 35 U.S.C. §103. In doing so, the Examiner has not provided any evidence as to why one of ordinary skill in the art would combine the references in the manner that the Examiner has proposed.

For example, as noted above, Appellant respectfully submits that one of ordinary skill in the art would not combine the etching apparatus of Tanaka with the electron beam lithography apparatus of Somekh to arrive at the device manufacturing method recited by claim 14. Moreover, the combination proposed by the Examiner does not provide each and every feature of claim 14. Specifically, as discussed above, the oxidizer of Somekh is

provided by the oxidizer source (216) in the activated state. The Examiner has provided no reasoning as to why one of ordinary skill in the art would modify Somekh to eliminate the oxidizer source (216) and significantly change where the oxidizer is generated.

Accordingly, the rejection of claim 14 as allegedly being obvious in view of Tanaka in view of Somekh is wholly inappropriate and must be withdrawn.

d) Claim 15

Claim 15 is patentable over Somekh, Tanaka and any combination thereof for at least the same reasons as provided above for claim 1 and for the features recited therein. In particular, the combination of Somekh and Tanaka fails to present a *prima facie* case of obviousness because: 1) there is no motivation or suggestion, either in the references themselves, or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings and 2) the combination does not include all the limitations of the claims. The Examiner has impermissibly used Appellant's claims as a blueprint to cobble together references and reject the claims under 35 U.S.C. §103. In doing so, the Examiner has not provided any evidence as to why one of ordinary skill in the art would combine the references in the manner that the Examiner has proposed.

Appellant respectfully submits that one of ordinary skill in the art would not combine the etching apparatus of Tanaka with the electron beam lithography apparatus of Somekh to arrive at the lithographic projection apparatus recited by claim 15. Moreover, the combination proposed by the Examiner does not provide each and every feature of claim 15. As discussed above, the Examiner has provided no reasoning whatsoever as to why one of ordinary skill in the art would modify Somekh to eliminate the oxidizer source (216) and significantly change where the oxidizer is generated, i.e. in the tube as recited in claim 15.

The Examiner asserts at page 6 of the Office Action that Somekh discloses that the radical source is disposed away from the radiation source such that operating conditions of the radical source do not adversely affect the beam of radiation. Appellant strenuously disagrees. The Examiner has not identified a single disclosure in Somekh that supports this assertion. If anything at all, Somekh **teaches away** from this feature. One need only look at FIG. 2A of Somekh to realize that (1) the oxygen source 216 (identified by the Examiner as being the "radical source" of claim 15) is located proximate the electron source 202 (identified by the Examiner as being the "radiation source"). Further, one can only look at FIG. 2A of Somekh to realize that the nozzle 224 of Somekh **supplies a flow of oxidizer toward the beam of radiation 203**. As such, there is simply no teaching or suggestion in

Somekh of a radical source disposed away from said radiation source such that operating conditions of said radical source do not adversely affect said beam of radiation, as recited in claim 15.

Accordingly, the rejection of claim 15 as allegedly being obvious in view of Tanaka in view of Somekh is wholly inappropriate and must be withdrawn.

e) Claims 16 and 20

Claims 16 and 20 are patentable over Somekh, Tanaka and any combination thereof at least by virtue of their dependency from claim 15 and for the additional features recited therein.

For example, the Examiner refers to col. 6, lns. 26-29 and col. 7, lns. 19-22 as allegedly disclosing, teaching or suggesting the additional features of claim 16. Appellant respectfully disagrees. According to claim 16, the radicals are formed in the tube and in the plasma region. Thus, according to claim 16, the plasma region is formed in the tube. By contrast, the cited portions of Somekh merely disclose forming the radicals in the oxidizer source 216, not in a tube. Nowhere do the cited portions of Somekh disclose, teach or suggest forming radicals in the tube that extends from the oxidizer source to the nozzle 215. Nor is there any teaching or suggestion in Somekh as to forming a plasma in the tube that extends from the oxidizer source to the nozzle 215. There simply is none.

Accordingly, the rejection of claim 16 as allegedly being obvious in view of Tanaka in view of Somekh is wholly inappropriate and must be withdrawn.

3. Claim 7 is Not Obvious Based on Somekh in View of Tanaka and Further in View of Horiike

The combination of Somekh, Tanaka and Horiike fails to present a *prima facie* case of obviousness because: 1) the combination does not include all the limitations of the claims, and 2) there is no motivation or suggestion, either in the references themselves, or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings.

Claim 7 is patentable over Somekh, Tanaka and any combination thereof at least by virtue of its dependency from claim 7 and for the additional features recited therein.

Horiike fails to remedy the deficiencies of Somekh and Tanaka. Somekh discloses an apparatus for processing the surface of a Si wafer. *See* Horiike at Abstract. The apparatus includes a cleaning chamber (3) for cleaning the wafer (1). *See* Horiike at col. 4, lns. 15-28. The wafer (1) is cleaned in the cleaning chamber (3) prior to being moved into the process

chamber (8) for processing. *See* Horiike at col. 5, lns. 27-48. A plasma generating section (4) has a plasma generating area (12) that is communicated to an inlet (11) of the cleaning chamber (3). *See* Horiike at col. 4, lns. 51-54. Unlike claim 7, Horiike does not teach that the plasma generating section is configured to be moved relative to the wafer or that the wafer may be moved relative to the plasma generating section so that a beam of radicals are incident on the surface of the wafer. Horiike discloses that the wafer is merely moved into and out of the cleaning chamber (3), and the inlet (11) generally provides the plasma to the chamber, and does not provide a beam of radicals that are incident on the surface of the wafer. Thus, any proper combination of Somekh, Tanaka and Horiike cannot result, in any way, in the invention of claim 7.

In addition, the Examiner has not provided the requisite analysis as to why one of ordinary skill in the art would combine the elements of Somekh, Tanaka and Horiike in the manner that the Examiner has proposed. *See KSR Int'l. Co. v. Teleflex, Inc.*, No. 04-1350, slip opinion at page 14 (U.S. Apr. 30, 2007) (a determination must be made as to "whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit"). Instead, the Examiner has only offered a conclusory statement that goes against the teachings of Somekh. This is clearly inadequate under the Supreme Court's *KSR* decision.

In particular, the Examiner asserts that "the artisan would have been motivated to further modify Somekh as modified in a matter described above for at least the purpose to clean a specified portion of the surface." *See* Office Action at page 7, lns. 6-8. Appellant strenuously disagrees. The Examiner must realize that the cleaning system of Somekh provides an atmosphere of oxidizer that conveniently and continuously cleans all the surfaces in the process chamber. Thus, it is not clear as to why one of ordinary skill in the art would modify Somekh "to clean a specified portion of the surface." If anything at all, the suggested motivation for combining Somekh in view of Horiike goes against the teachings of Somekh, which discloses that the cleaning should not drastically affect the throughput of the lithographic system. *See* Somekh at col. 2, lns. 64-67 and col. 3, lns.1-6. Modifying the cleaning process of Somekh by using a system that locally cleans a surface of a component would, according to Somekh, not only be very expensive and time consuming, but would also limit the throughput of the lithographic system. *Id.* Accordingly, one of ordinary skill in the art would not be motivated to modify the cleaning system of Somekh based on Tanaka in the manner the Examiner has proposed.

In view of the foregoing, Appellant respectfully submits that claim 7 is patentable over Somekh in view of Tanaka in view of Horiike, and respectfully requests that the rejection to claim 7 be withdrawn.

4. Claim 17 is Not Obvious Based on Somekh in View of Tanaka and Further in View of Sakai

The combination of Somekh, Tanaka and Sakai fails to present a *prima facie* case of obviousness because: 1) the combination does not include all the limitations of the claims, and 2) there is no motivation or suggestion, either in the references themselves, or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings.

Claim 17 is patentable over Somekh, Tanaka and any combination thereof at least by virtue of its dependency from claim 17 and for the additional features recited therein.

Sakai fails to remedy the deficiencies of Somekh and Tanaka. Sakai discloses a discharge tube (18) that selectively supplies active species of F*(radical) and O*(radical) to a chamber (3) through an active species introduction port (19). *See* Sakai at col. 3, lns. 49-58. The active species are generally supplied to the chamber (3) and are not formed into a localized beam. *See* Sakai at col. 3, ln. 62 – col. 4, ln. 39. Sakai discloses that the introduction port (19) should be positioned near the portion of the apparatus that has the most serious problem of contamination, *see* Sakai et al. at col. 7, lns. 61-65, but does not disclose that the discharge tube may be moved relative to a component having a surface to be cleaned or that a component having a surface to be cleaned may be moved relative to the discharge tube so that a beam of radicals is incident on the surface to be cleaned. Thus, any proper combination of Somekh, Tanaka and Sakai cannot result, in any way, in the invention of claim 17.

In addition, the Examiner has not provided the requisite analysis as to why one of ordinary skill in the art would combine the elements of Somekh, Tanaka and Sakai in the manner that the Examiner has proposed. *See KSR Int'l. Co. v. Teleflex, Inc.*, No. 04-1350, slip opinion at page 14 (U.S. Apr. 30, 2007) (a determination must be made as to "whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit"). Instead, the Examiner has only offered a conclusory statement that goes against the teachings of Somekh. This is clearly inadequate under the Supreme Court's *KSR* decision.

In particular, the Examiner asserts that "the artisan would have been motivated to further modify Somekh as modified to utilize a discharge tube to provide a more uniform stream of neutralized ion particles." *See* Office Action at page 8, lns. 1-3. Appellant strenuously disagrees.

First, **there are no such things as "neutralized ion particles."** An ion is by definition a charged particle and, as such, is **not** a neutralized particle. It is not clear what the Examiner is referring to with "neutralized ion particles".

Second, and assuming, *arguendo*, that the Examiner equates "neutralized ion particles" with "radicals" or "neutral particles," it is not clear as to how a "more uniform stream" of radicals would be provided if ions are neutralized, as alleged by the Examiner. The Examiner must realize that charged particles, *i.e.*, ions, will not interact with radicals, which are, by definition, not charged. On the other hand, assuming, *arguendo*, that the Examiner equates "neutralized ion particles" with "ion particles to be neutralized," it is not clear as to how a "more uniform stream" of "ion particles to be neutralized" would be provided, nor is it clear as to why it would be desirable to provide such "a more uniform stream" since, as mentioned previously, ions (*i.e.*, charged particles) do not interact with radicals (*i.e.*, neutral particles). Clearly, the Examiner's reason for combining and modifying Somekh in view of Sakai are not in line with the elementary laws of physics. Further, the lack of any cogent reason or objective evidence to modify Somekh in view of Sakai is a fundamental shortcoming of the Examiner's rejection, and shows that the Examiner is simply engaging in a piecemeal and hindsight reconstruction of the prior art.

Accordingly, Appellant respectfully submits that claim 17 is patentable over Somekh in view of Tanaka in view of Sakai and respectfully requests that the rejection be withdrawn.

5. Claims 18 and 19 are Not Obvious Based on Somekh in View of Tanaka and Further in View of Vane

The combination of Somekh, Tanaka and Vane fails to present a *prima facie* case of obviousness because: 1) the combination does not include all the limitations of the claims, and 2) there is no motivation or suggestion, either in the references themselves, or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings.

Claims 18 and 19 are patentable over Somekh, Tanaka and any combination thereof at least by virtue of their dependency from claim 15 and for the additional features recited therein.

Vane fails to remedy the deficiencies of Somekh and Tanaka. Vane discloses a method and apparatus for cleaning electron microscopes. *See* Vane at Abstract. Vane discloses that a plasma chamber (50) is provided to project a plasma into the full specimen chamber (4). *See* Vane at col. 7, ln. 54 – col. 8, ln. 3; FIG. 1. The plasma chamber (50) is separate from the gas supply (42) and gas from the gas supply (42) is fed into the chamber (4) and into the plasma. *See* Vane at col. 8, lns. 17-26; FIG. 1. Oxygen radicals from the plasma are carried into the chamber by convection. *See* Vane at col. 8, lns. 24-25. Vane does not disclose or suggest that the plasma generates a localized beam of radicals or that the plasma chamber may be moved relative to a component having a surface to be cleaned or that a component having a surface to be cleaned may be moved relative to the plasma chamber so that a beam of radicals is incident on the surface to be cleaned.

Thus, any proper combination of Somekh, Tanaka and Vane cannot result, in any way, in the invention of claims 18 and 19.

The Examiner refers to col.7, lines 62-65 of Vane as allegedly disclosing, teaching or suggesting a faraday grid. Appellant strenuously disagrees. Vane specifically states that the conductive screen (53) described at col. 7, lns. 62-66 is **not** a trap for the charged species of the plasma, but instead confines the electric fields and defines and fixes the impedance between the glow electrode (51) and the plasma chamber (50) walls. *See* Vane at col. 7, lns. 62-66 ("**Screen 53 is not a trap for the charged species of the plasma**," emphasis added). Thus, the Examiner's determination that screen 53 of Vane is a Faraday grid as in claims 18 and 19 is simply incorrect. There is simply no disclosure whatsoever in Vane of a Faraday grid that neutralizes the ionized particles, as recited by claims 18 and 19.

For at least this additional reason, any proper combination of Somekh, Tanaka and Vane cannot result, in any way, in the invention of claims 18 and 19.

In addition, the Examiner has not provided the requisite analysis as to why one of ordinary skill in the art would combine the elements of Somekh, Tanaka and Vane in the manner that the Examiner has proposed. *See KSR Int'l. Co. v. Teleflex, Inc.*, No. 04-1350, slip opinion at page 14 (U.S. Apr. 30, 2007) (a determination must be made as to "whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit"). Instead, the Examiner has only offered a conclusory statement that goes against the teachings of Somekh and Vane. This is clearly inadequate under the Supreme Court's *KSR* decision.

In particular, the Examiner asserts that "the artisan would have been motivated to further modify Somekh as modified to utilize a discharge tube to provide a more uniform stream of neutralized ion particles." *See* Office Action at page 8, lns. 1-3. Appellant strenuously disagrees.

First, as noted above, Vane explicitly teaches that screen 53, which is located at the gas exit of the plasma chamber, is **not** a trap for the charged species of the plasma. Thus, if anything at all, Vane **teaches away** from using a Faraday grid provided at the orifice of a tube.

Second, as noted above, **there are no such things as "neutralized ion particles."** An ion is by definition a charged particle and, as such, is **not** a neutralized particle. It is not clear what the Examiner is referring to with "neutralized ion particles."

Third, and assuming, *arguendo*, that the Examiner equates "neutralized ion particles" with "radicals" or "neutral particles," it is not clear as to how a "more uniform stream" of radicals would be provided if ions are neutralized, as alleged by the Examiner. The Examiner must realize that charged particles, *i.e.*, ions, will not interact with radicals, which are, by definition, not charged. On the other hand, assuming, *arguendo*, that the Examiner equates "neutralized ion particles" with "ion particles to be neutralized," it is not clear as to how a "more uniform stream" of "ion particles to be neutralized" would be provided, nor is it clear as to why it would be desirable to provide such "a more uniform stream" since, as mentioned previously, ions (*i.e.*, charged particles) do not interact with radicals (*i.e.*, neutral particles). Clearly, the Examiner's reason for combining and modifying Somekh in view of Vane are not in line with the elementary laws of physics. Further, the lack of any cogent reason or objective evidence to modify Somekh in view of Vane is a fundamental shortcoming of the Examiner's rejection, and shows that the Examiner is simply engaging in a piecemeal and hindsight reconstruction of the prior art.

Accordingly, Appellant respectfully submits that claims 18 and 19 are patentable over Somekh in view of Tanaka and Vane and respectfully requests that the rejection be withdrawn.

V. CONCLUSION

For at least the reasons discussed above, it is respectfully submitted that claims 1-20 are not anticipated or rendered obvious by the cited references. For the above reasons, Appellant respectfully requests this Honorable Board to reverse the rejections of claims 1-20.

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VI. CLAIMS APPENDIX - 37 C.F.R. §41.37(c)(1)(viii)

Claims 1-20 are as follows:

1. A lithographic projection apparatus comprising:

a support structure constructed to support a patterning device, said patterning device being configured to pattern a beam of radiation according to a desired pattern;

a substrate holder constructed to hold a substrate;

a projection system constructed and arranged to project the patterned beam onto a target portion of the substrate; and

a downstream radical source having a tube connected to a gas supply and configured to provide a beam of radicals directed onto a surface of a component to be cleaned,

wherein the radicals are generated within a flow of gas from the gas supply in the tube, and

wherein the tube of the radical source is constructed and arranged to be moved relative to the surface to be cleaned and/or the component is constructed and arranged to be moved relative to the tube of the radical source so that the beam of radicals is incident on the surface to be cleaned.

2. A lithographic projection apparatus according to claim 1, wherein said beam of radicals contains substantially no ionized particles.

3. A lithographic projection apparatus according to claim 1, wherein said gas supply supplies at least one of oxygen, hydrogen, or fluorine.

4. A lithographic projection apparatus according to claim 3, wherein said downstream radial source provides a beam of at least one of oxygen radicals, hydrogen radicals, or fluorine radicals.

5. A lithographic projection apparatus according to claim 1, wherein said surface of the component to be cleaned is on one of the patterning device, a sensor, a lens, a deflector, or a beam reflector.

6. A lithographic projection apparatus according to claim 1, wherein the position of the downstream radical source is fixed.

7. A lithographic projection apparatus according to claim 6, further comprising a structure to direct said beam of radicals onto said surface to be cleaned, said structure comprising a device that moves the component containing said surface such that the beam of radicals is incident on said surface.

8. A lithographic projection apparatus according to claim 1, wherein the downstream radical source comprises one or more of an RF coil, a pair of DC discharge electrodes, a microwave cavity, and an RF cavity that generates a region of plasma within the flow of gas from the gas supply, the radicals being created in said plasma region.

9. A lithographic projection apparatus according to claim 1, wherein the downstream radical source comprises a high temperature element located within the flow of the gas from the gas supply, the temperature of the high temperature element being sufficient to cause thermal dissociation to create the radicals.

10. A lithographic projection apparatus according to claim 1, further comprising:

an evacuated chamber that contains the patterning device, the substrate, and the projection system,

wherein the beam of radicals are discharged from an end of said tube, and said end of the tube is located in the evacuated chamber.

11. A lithographic projection apparatus according to claim 10, wherein the region of the downstream radical source in which the radicals are formed is located outside of the evacuated chamber.

12. A lithographic projection apparatus according to claim 1, wherein the apparatus comprises at least two downstream radical sources and corresponding beams of radicals for cleaning said surface.

13. A lithographic projection apparatus according to claim 1, wherein said surface of the component to be cleaned comprises a surface of an optical element.

14. A device manufacturing method comprising:

providing a beam of radiation;

patterning the beam of radiation;

projecting the patterned beam of radiation onto a target portion of a layer of radiation-sensitive material;

providing a flow of gas from a gas supply;

generating a beam of radicals in the flow of gas from the gas supply in a tube of a downstream radical source;

moving the tube of the radical source relative to a component comprising a surface to be cleaned and/or moving the component relative to the tube of the radical source; and

directing said beam of radicals onto the surface to be cleaned so that the beam of radicals is incident on the surface to be cleaned.

15. A lithographic projection apparatus comprising:

a radiation source that provides a beam of radiation;

a support structure constructed to support a patterning device, said patterning device being configured to pattern the beam of radiation according to a desired pattern;

a substrate holder constructed to hold a substrate;

a projection system constructed and arranged to project the patterned beam onto a target portion of the substrate;

a radical source connected to a gas supply and configured to generate a localized beam of radicals in a flow of gas from the gas supply in a tube of the radical source; and

a structure to direct said beam of radicals onto a surface to be cleaned,

wherein said radical source is disposed away from said radiation source such that operating conditions of said radical source do not adversely affect said beam of radiation, and

wherein the tube of the radical source is constructed and arranged to be moved relative to a component comprising the surface to be cleaned and/or the component is constructed and arranged to be moved relative to the tube of the radical source so that the localized beam of radicals is incident on the surface to be cleaned.

16. A lithographic projection apparatus according to claim 15, wherein said radical source comprises:

a plasma generator to generate a plasma region,

wherein gas from the gas supply flows through the tube and through the plasma region such that neutral and ionized particles are created, and

the beam of radicals exits the tube at an orifice onto the surface to be cleaned.

17. A lithographic projection apparatus according to claim 16, wherein walls of the tube neutralize the ionized particles.

18. A lithographic projection apparatus according to claim 16, wherein a Faraday grid neutralizes the ionized particles.

19. A lithographic apparatus according to claim 18, wherein the Faraday grid is disposed at the orifice of the tube.

20. A lithographic apparatus according to claim 15, wherein said surface to be cleaned comprises a surface of an optical element.

VII. EVIDENCE APPENDIX – 37 C.F.R. § 41.37(c)(1)(ix)

None.

VIII. RELATED PROCEEDINGS APPENDIX – 37 C.F.R. § 41.37(c)(1)(x)

None.